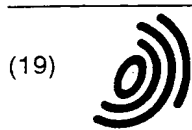


Granted EP Pat.

Corresponding to 09/889,603

U.S.



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11) EP 1 165 324 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention  
of the grant of the patent:  
23.06.2004 Bulletin 2004/26

(51) Int Cl.7: B41M 5/00, D21H 17/65,  
D21H 17/67, G03G 7/00

(21) Application number: 00901205.5

(86) International application number:  
PCT/GB2000/000202

(22) Date of filing: 27.01.2000

(87) International publication number:  
WO 2000/044568 (03.08.2000 Gazette 2000/31)

(54) INK-RECEPTOR SHEET FOR USE AS A RECORDING MATERIAL

FARBSTOFFEMPfangsBLATT, DAS ALS AUfZEICHNUNGSMATERIAL VERWENDET WIRD  
FEUILLE DE RECEPTION D'ENCRE DESTINEE A ETRE UTILISEE COMME MATIERE  
D'ENREGID'INSCRIPTION

(84) Designated Contracting States:  
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE

(56) References cited:  
EP-A- 0 673 779 EP-A- 0 734 881  
EP-A- 0 879 917 EP-A- 0 887 199  
US-A- 5 593 489

→ (30) Priority: 28.01.1999 GB 9901750

(43) Date of publication of application:  
02.01.2002 Bulletin 2002/01

(60) Divisional application:  
02022503.3 / 1 270 250

(73) Proprietor: Arjo Wiggins Fine Papers Limited  
Basingstoke, Hampshire RG24 8BA (GB)

- PATENT ABSTRACTS OF JAPAN vol. 1998, no. 3, 27 February 1998 (1998-02-27) & JP 09 290556 A (MITSUBISHI PAPER MILLS, LIMITED), 11 November 1997 (1997-11-11)
- PATENT ABSTRACTS OF JAPAN vol. 10, no. 200 (M-498), 12 July 1986 (1986-07-12) & JP 61 043593 A (MITSUBISHI PAPER MILLS, LIMITED), 3 March 1986 (1986-03-03)

Remarks:

The file contains technical information submitted after the application was filed and not included in this specification

→ (72) Inventor: CALLAND, Stevan George  
Glossop SK13 1BX (GB)

(74) Representative: Raynor, Simon Mark et al  
Urquhart-Dykes & Lord LLP  
Midsummer House,  
413 Midsummer Boulevard  
Central Milton Keynes MK9 3BN (GB)

Corresponding EP Granted  
Patent to present  
U.S. application.

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

## Description

[0001] The present invention relates to the use of a recording sheet in a digital printing process on a digital printing press, and in particular using the Indigo™ digital printing process, which involves the transfer of liquid toner to the recording sheet by electrophotography.

[0002] The Indigo digital press made by Indigo NV requires special paper surfaces to enable complete toner/ink transfer from printing blanket to paper. Such complete transfer is essential to allow variable information to be printed on successive sheets.

[0003] It is known that commercially available pigment coated printing papers satisfy the requirement of 100% toner transfer, however for aesthetic and cost reasons printers wish to use papers of uncoated appearance. For instance: a translucent or semi-translucent paper would have its translucency diminished by pigment coating; coated papers are often glossy; the surface texture of an uncoated paper feels more natural.

[0004] Two processes have been developed to treat paper to render it suitable for the Indigo press. One developed by Indigo NV and described in International patent application WO96/06384 is commercially known as the Sapphire treatment and involves treating the paper with polyethylene imine. That developed by Arjo Wiggins and described in EP 0879917 A2 involves use of a surface treatment that includes an aluminate salt or a salt of a weak acid/strong base to render the surface alkaline.

[0005] It is an object of the present invention to provide a paper or a range of papers of uncoated appearance that are suitable for use on an Indigo press and also in other digital and non-digital processes, and which also have an increased shelf life.

[0006] The present invention is characterised by the use of a recording sheet in a digital printing process on a digital printing press; wherein the digital printing process is a process that involves the transfer of liquid toner to the recording sheet by electrophotography and the recording sheet includes a paper substrate containing an insoluble mineral filler, said filler including aluminium trihydrate.

[0007] Advantageously, the paper substrate contains between 50 and 400, preferably between 100 and 300, more preferably approximately 200 parts dry weight of aluminium trihydrate to 800 parts dry weight of pulp.

[0008] Advantageously, the recording sheet has a surface treatment including magnesium sulphate and polyvinyl pyrrolidone. The surface treatment may be applied to the paper at a rate of 2 to 4g/m<sup>2</sup>.

[0009] Advantageously, the recording sheet has a surface treatment including starch and polyvinyl alcohol. The surface treatment may include an optical brightening agent. The surface treatment may be applied to the paper at a rate of 1 to 2g/m<sup>2</sup>.

[0010] Advantageously, the recording sheet has a surface treatment including a soluble or insoluble metal from Groups II and III or the Transition Metals of the Periodic Table.

[0011] Advantageously, the recording sheet is substantially opaque.

[0012] We have found that three things work particularly effectively:

1. Translucent paper with a surface treatment of polyvinyl pyrrolidone + magnesium sulphate + Baysynthol KSN synthetic sizing agent.

2. Opaque paper with an insoluble mineral filler of aluminium trihydrate (Martifill) and a surface treatment of polyvinyl pyrrolidone + MgSO<sub>4</sub>.

3. Opaque paper with an insoluble mineral filler of aluminium trihydrate and a conventional paper surface treatment, e.g. starch plus polyvinyl alcohol.

[0013] Formulae 2 and 3 above comprise exemplary embodiments of the invention.

[0014] The results of using the above formulae are summarised in the following table:

Printability	Indigo	Litho	Inkjet inc. pigment inks	Hotmelt Inkjet	Laser (mono & colour)	Fountain pen
Formula 1	yes	yes	yes	yes	yes	yes
Formula 2	yes	yes	yes	yes	yes	yes
Formula 3	yes	yes	yes	yes	yes	yes

[0015] The surface treatment in formulae 1 and 2 is the same as the one we claimed for pigment based ink-jet on translucent paper, described in patent GB 2 301 845 B the contents of which are incorporated by reference herein. Formula 2 also includes aluminium trihydrate as a filler in the base, in addition to the surface treatment.

[0016] It would seem that the Baysynthol is not essential for the Indigo process. The suitability of the paper for use in the Indigo process appears to depend on either the presence of either a soluble metal cation ( $Mg^{2+}$ ) at the surface or a Lewis acid filler ( $Al(OH)_3$ ) in the base or a slightly "tacky" polymer such as polyvinyl pyrrolidone or polyvinyl alcohol at the surface of the paper. We suspect that the group II or III metals are the key. Further investigation of this aspect of the invention is required. The present invention is concerned particularly with the second of these three possibilities.

[0017] The preferred surface formulation for 1 and 2 is:

	parts by dry weight	e.g.
magnesium sulphate	75	Luviskol K90 Baysynthol KSN B
polyvinyl pyrrolidone	25	
Styrene copolymer size	0 to 2.5	
Typical application weight:	0.5 to 5 g/m <sup>2</sup>	

[0018] The styrene copolymer size is not essential in the formulation for formula 2 (opaques) but is needed in formula 1 (translucent papers).

[0019] Variants of the formulae, for example as described in GB 2301 845B are possible. For example:

<b>cation</b>	polyvalent metals ions of groups II and III and transition metals of the periodic table
<b>cation</b>	poly quaternary amine or other Lewis acids
<b>Binder</b>	starch, cationic starch, carboxymethyl cellulose, gelatine, polyvinyl alcohol, polyvinyl pyrrolidone, singly or in admixture of 2 or more
<b>Base</b>	opacity 20 to 98+, grammage 40 to 300
<b>Size</b>	styrene maleic anhydride, polyacrylate, styrene acrylate or other sizes known in the art

Formulation for Base for 2 and 3:

[0020] Aluminium hydroxide also known as trihydrate (e.g. Martifill P2) 18% on dry fibre. Possible variants include the internal sizes and different particle size of filler.

Surface formulation for 3

[0021]

Starch	200 dry parts	e.g. oxidised potato - Amylox P45 from Avebe
Polyvinyl alcohol	25 dry parts	e.g. gohsenol GL05 from Nippon Gohsei

Possible variants include cationic starch, other starches, different PVOHs.

[0022] For increased sheet brightness, an optical brightening agent (OBA) may be included in the surface treatment. We have found that it is beneficial to split the surface treatment into two applications: a) starch plus polyvinyl alcohol plus OBA and then b) magnesium sulphate plus polyvinyl pyrrolidone. The effect of this is to separate application of OBA and magnesium sulphate, which can react with each other and so mutually interfere with the desired function of each.

[0023] An example of a process for making a recording sheet according to a preferred embodiment of the invention will now be described. A papermaking stock slurry in water was made from 800 parts dry weight of commercial bleached chemical pulp and 200 parts dry weight of Martifill P2 aluminium trihydrate (available from Martinswerk GmbH). To this was added 2 parts dry weight of alkyl ketene dimer to serve as an internal sizing agent. Retention aids, dyes and optical brightening agents may also be added to suit the particular paper making process and the desired paper aesthetics.

[0024] The stock slurry was formed into a web of paper on a Fourdrinier paper machine. Other formers would also serve.

[0025] A first surface application was applied to the paper comprising an aqueous mix of (by dry weight parts) 50 parts Amylox P45 oxidised potato starch (available from Avebe b.a.) and 25 parts of Gohsenol GL05 polyvinyl alcohol (available from Nippon Gohsei). To this may be added an optical brightening agent to suit the desired aesthetic properties of the paper. This mix was applied to the paper at a rate of 1g/m<sup>2</sup> to 2g/m<sup>2</sup>.

[0026] A second surface application was applied to the paper comprising an aqueous mix of (by dry weight parts) 75 parts of magnesium sulphate and 25 parts of Luviskol K90 polyvinyl pyrrolidone (available from BASF GmbH). This

mix was applied to the paper at a rate of 2g/m<sup>2</sup> to 4g/m<sup>2</sup>.

[0027] The finished paper had an attractive, uncoated appearance and was found to give good results on the Indigo digital printing press, as well as in the Xeikon digital printing press and with litho, inkjet, mono and colour laser printers and fountain pens. The paper therefore has universal applicability.

## Claims

1. Use of a recording sheet in a digital printing process on a digital printing press; wherein the digital printing process is a process that involves the transfer of liquid toner to the recording sheet by electrophotography and the recording sheet includes a paper substrate containing an insoluble mineral filler, said filler including aluminium trihydrate.
2. Use of a recording sheet according to claim 1, wherein the paper substrate contains between 50 and 400, preferably between 100 and 300, more preferably approximately 200 parts dry weight of aluminium trihydrate to 800 parts dry weight of pulp.
3. Use of a recording sheet according to any one of the preceding claims, wherein the recording sheet has a surface treatment including magnesium sulphate and polyvinyl pyrrolidone.
4. Use of a recording sheet according to claim 3, wherein the surface treatment including magnesium sulphate and polyvinyl pyrrolidone is applied to the paper at a rate of 2 to 4g/m<sup>2</sup>.
5. Use of a recording sheet according to any one of the preceding claims, wherein the recording sheet has a surface treatment including starch and polyvinyl alcohol.
6. Use of a recording sheet according to claim 5, wherein the surface treatment including starch and polyvinyl alcohol includes an optical brightening agent.
7. Use of a recording sheet according to claim 5 or claim 6, wherein the surface treatment including starch and polyvinyl alcohol is applied to the paper at a rate of 1 to 2g/m<sup>2</sup>.
8. Use of a recording sheet according to any one of the preceding claims, wherein the recording sheet has a surface treatment including a soluble or insoluble metal from Groups II and III or the Transition Metals of the Periodic Table.
9. Use of a recording sheet according to any one of the preceding claims, wherein the recording sheet is substantially opaque.

## Patentansprüche

1. Verwendung eines Aufzeichnungsblatts in einem digitalen Druckprozess auf einer digitalen Druckerpresse; wobei der digitale Druckprozess den Transfer eines flüssigen Toners zu dem Aufzeichnungsblatt durch Elektrofotografie einschließt und das Aufzeichnungsblatt einen Papierträger umfasst, der einen unlöslichen Mineralfüllstoff enthält, der Aluminiumtrihydrat enthält.
2. Verwendung eines Aufzeichnungsblatts nach Anspruch 1, wobei der Papierträger zwischen 50 und 400, vorzugsweise 100 und 300 und besonders bevorzugt ungefähr 200 Teile des Trockengewichts von Aluminiumtrihydrat zu 800 Teilen des Trockengewichts des Faserstoffes enthält.
3. Verwendung eines Aufzeichnungsblatts nach einem der vorhergehenden Ansprüche, wobei das Aufzeichnungsblatt eine Oberflächenbehandlung aufweist, die Magnesiumsulfat und Polyvinylpyrrolidon enthält.
4. Verwendung eines Aufzeichnungsblatts nach Anspruch 3, wobei die Magnesiumsulfat und Polyvinylpyrrolidon umfassende Oberflächenbehandlung mit einem Verhältnis von 2 bis 4 g/m<sup>2</sup> aufgetragen wird.
5. Verwendung eines Aufzeichnungsblatts nach einem der vorhergehenden Ansprüche, wobei das Aufzeichnungsblatt eine Oberflächenbehandlung aufweist, die Stärke und Polyvinylalkohol enthält.

6. Verwendung eines Aufzeichnungsblatts nach Anspruch 5 oder 6, wobei die Stärke und Polyvinylalkohol umfassende Oberflächenbehandlung einen optischen Aufheller enthält.
7. Verwendung eines Aufzeichnungsblatts nach Anspruch 5, wobei die Stärke und Polyvinylalkohol umfassende Oberflächenbehandlung mit einem Verhältnis von 1 bis 2 g/m<sup>2</sup> aufgetragen wird.
8. Verwendung eines Aufzeichnungsblatts nach einem der vorhergehenden Ansprüche, wobei das Aufzeichnungsblatt eine Oberflächenbehandlung aufweist, die ein lösliches oder unlösliches Metall der Gruppen II und III oder der Übergangsmetalle des Periodensystems enthält.
9. Verwendung eines Aufzeichnungsblatts nach einem der vorhergehenden Ansprüche, wobei das Aufzeichnungsblatt im wesentlichen undurchsichtig ist.

# Revendications

1. Utilisation d'une feuille d'enregistrement dans un procédé d'impression numérique sur une presse d'imprimerie numérique ; dans laquelle le procédé d'impression numérique est un procédé qui implique le transfert de toner liquide sur la feuille d'enregistrement par électrophotographie et la feuille d'enregistrement comprend un support papier contenant une charge minérale insoluble, ladite charge comprenant du trihydrate d'aluminium.
2. Utilisation d'une feuille d'enregistrement selon la revendication 1, dans laquelle le support papier contient entre 50 et 400, de préférence entre 100 et 300, ou mieux approximativement 200 parties en poids sec de trihydrate d'aluminium pour 800 parties en poids sec de pâte.
3. Utilisation d'une feuille d'enregistrement selon l'une quelconque des revendications précédentes, dans laquelle la feuille d'enregistrement a un traitement de surface comprenant le sulfate de magnésium et la polyvinylpyrrolidone.
4. Utilisation d'une feuille d'enregistrement selon la revendication 3, dans laquelle le traitement de surface comprenant le sulfate de magnésium et la polyvinylpyrrolidone est appliqué sur le papier à raison de 2 à 4 g / m<sup>2</sup>.
5. Utilisation d'une feuille d'enregistrement selon l'une quelconque des revendications précédentes, dans laquelle la feuille d'enregistrement a un traitement de surface comprenant de l'amidon et de l'alcool polyvinylique.
6. Utilisation d'une feuille d'enregistrement selon la revendication 5, dans laquelle le traitement de surface comprenant de l'amidon et de l'alcool polyvinylique comprend un agent optique de blanchiment.
7. Utilisation d'une feuille d'enregistrement selon la revendication 5 ou la revendication 6, dans laquelle le traitement de surface comprenant l'amidon et l'alcool polyvinylique est appliqué sur le papier à raison de 1 à 2 g / m<sup>2</sup>.
8. Utilisation d'une feuille d'enregistrement selon l'une quelconque des revendications précédentes, dans laquelle la feuille d'enregistrement a un traitement de surface comprenant un métal soluble ou insoluble des groupes II et III ou des métaux de transition du tableau périodique.
9. Utilisation d'une feuille d'enregistrement selon l'une quelconque des revendications précédentes, dans laquelle la feuille d'enregistrement est essentiellement opaque.

THIS PAGE BLANK (USPTO)